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January 13, 2005

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APPLICATION NUMBER: *60/531,727*
FILING DATE: *December 22, 2003*
RELATED PCT APPLICATION NUMBER: *PCT/US04/41855*

Certified By

Jon W Dudas

Under Secretary
of Commerce for Intellectual Property
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PTO/SB/16 (08-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

Express Mail Label no. EL995078824US

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Max Ward	Muterspaugh	Indianapolis, Indiana
Matthew Thomas	Mayer	Indianapolis, Indiana

☐ *Additional inventors are being named on the ____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

AUTOMATIC GAIN CONTROL WITH OPTIMUM ADJACENT CHANNEL PROTECTION

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☐ Customer Number

OR

☒ Firm or Individual Name	JOSEPH S. TRIPOLI, THOMSON LICENSING INC.				
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ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* 5 ☐ CD(s), Number ____

☒ Drawing(s) *Number of Sheets* 2 ☐ Other (specify) ____

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fees

FILING FEE AMOUNT ($)

☒ The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 07-0832

$160

☐ Payment by credit card. Form PTO-2038 is attached.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☐ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ____.

Respectfully submitted,

SIGNATURE _____ Date 12/22/03

TYPED or PRINTED NAME Harvey D. Fried REGISTRATION NO. *(if appropriate)* 28,298

TELEPHONE 609-734-6811 Docket Number: PU030331

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

PTO/SB/17 (08-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2003

Effective 01/01/2003. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 160

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Max Ward Muterspaugh
Examiner Name	
Art Unit	
Attorney Docket No.	PU030331

METHOD OF PAYMENT *(check all that apply)*

☐ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☒ Deposit Account:

Deposit Account Number: 07-0832

Deposit Account Name: THOMSON LICENSING INC.

The Director is authorized to: *(check all that apply)*

☒ Charge fee(s) indicated below ☒ Credit any overpayments
☐ Charge any additional fee(s) during the pendency of this application
☐ Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	160

SUBTOTAL (1) ($) 160

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		- ** =	0	X		=	0
Independent Claims		- ** =	0	X		=	0
Multiple Dependent				X		=	0

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

"or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet.	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive – unavoidable	
1453	1,330	2453	665	Petition to revive – unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17 (q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	
				Other fee (specify) ____	

*Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($) 0

SUBMITTED BY				Complete *(if applicable)*	
Name (Print/Type)	Harvey D. Fried	*Registration No. (Attorney/Agent)*	28,298	*Telephone*	609-734-6811
Signature				*Date*	December 22, 2003

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Express Mail Label no. EL995078824US

PU030331

Automatic Gain control With Optimum Adjacent Channel Protection

Field of the Invention

This invention relates to the field of tuners, and in particular, the field of television tuners with automatic gain control.

Description of Related Art

When a relatively weak signal is being received, the presence of much stronger adjacent interfering signals can overload the tuner and prevent reception due to the resulting distortion. Prior art circuits detected the presence of strong adjacent channels and applied this to reduce the gain of the tuner. This previous solution did not function well for interference much stronger than the desired. It also did not make an optimum function for both analog and digital interfering signals.

The previous solutions allow a great deal of the adjacent channel signals to affect the gain control function. This results in an excessive reduction of tuner gain in the presence of strong interference. The previous implementation attempted to use a microprocessor algorithm to correct this. It did not make provisions for whether the interference was from a digital or analog signal. Reference is made to "NXT2002 Application Note: NXT2002 MEV Automatic Gain Control" by Nxtwave Communications, div. of ATI, One Summit Square, Route 413 and Doublewoods Road, Langhorne, PA 19047.

Summary of the Invention

In accordance with the inventive arrangements, the automatic gain control of a television tuner is modified to include the presence of an adjacent interfering channel. This frequency response of the circuitry deriving such control is optimized for the presence of either analog or digital interfering signals.

Detailed Description of the Preferred Embodiments

Figure 1 is a block diagram of a modern television receiver equipped to receive both analog and digital signals. The significant sections are a tuner for selecting a desired television channel, amplifying and converting that channel to an intermediate frequency (IF) of 41 to 47 MHz, a filtering and amplification means to remove undesired channels and prepare the signal for demodulation and further processing to audio and video outputs. The received signals vary greatly in amplitude and a further means of deriving an automatic gain control signal is provided and applied to the tuner at a gain control input such that this variation may be compensated.

Prior to the introduction of digital television, adjacent channel frequencies were never assigned in the same geographical region. This practice, in the vast majority of cases, prevented interference from adjacent channels. For cable delivery, adjacent channels are permitted, but the relative levels are carefully controlled such that extremely adverse variations in signal level are not present.

With the introduction of digital television, it was required that adjacent channels be used such that both analog and digital signals could be transmitted during the transition period until virtually all televisions receivers had been replaced with new units capable of digital reception. This has resulted in increased interference and a new problem in which relatively weak digital television signals can suffer interference from adjacent analog or digital signals that can be relatively much stronger than before.

In a previous implementation, a gain reduction control was derived by sampling the signal present at the output of the tuner before any significant filtering was applied to remove the adjacent channel signals. This is indicated as "point A" in Figure 1. In operation without interference, the

desired signal is converted into a control voltage and applied to reduce the tuner gain in a manner to maintain a nearly constant output signal from the tuner. With the presence of adjacent channel interference, those signals also contribute to the control voltage to further reduce the tuner gain. This prevents overload in the tuner and allows reception with moderately adverse conditions. A problem exists with extremely strong adjacent channel signals, for example 20 to 40 dB stronger than the desired channel, when this gain control signal is dominated by the interference. The tuner gain is reduced to a very low level such that the desired signal is below a critical level for proper demodulation and/or obscured by noise. Various solutions have been attempted using a microprocessor control to correct for this, but a problem exits in that the converted control signal is dominated by the interference and has little information regarding the amplitude of the desired signal. The converter for the control signal also responds differently in the presence of analog and digital interfering signals.

A first part of the invention is to derive the control from a signal that has been carefully filtered to remove a majority of the adjacent channel interference. This is indicated by "Point B" in Figure 2. The preceding SAW (surface acoustic wave) filter SAW1 is primarily wide enough to pass the desired channel, but also allows a small amount of the adjacent channel signal to pass. This can be amplified, converted into a control voltage and processed to control the tuner gain. Such control is made to reduce tuner gain as the signals at Point B increase. By controlling the amount of adjacent channel signal with the bandwidth of such filter, the amount of influence of adjacent channel power can be controlled.

Digital television signals are characterized by having a very uniform distribution of power over the bandwidth of that signal. For example, if the signal is filtered to remove half of the bandwidth, the power is reduced by half. Thus, the influence of digital interfering signals is easily controlled. At the converted IF (intermediate frequency) output of the tuner, the desired signal is between 41 and 47 MHz. By extending the frequency response of the filter SAW1 to slightly exceed this range, the control range provided by digital adjacent channel interference can be well controlled.

A second problem exists with analog interference. In analog television, the signal power is concentrated near the carriers, specifically the picture and sound carriers. In the presence of analog interference, the adjacent sound carrier is very close to the band edge of the desired, specifically 47.25 MHz. It was discovered that the presence of that sound carrier produced too much power and adversely reduced the tuner gain more than desired. Thus, a simple filter solution by adjusting the SAW filter bandwidth did not work optimally for both digital and analog interference.

A second part of the invention is to introduce a narrow stop band filter, or "trap" to specifically control the level of such an analog sound carrier. One such implementation is shown in Figure 3 with the addition of circuit elements L3, C9, R9, and X1. Specifically, the element X1 is a ceramic resonator tuned to shunt 47.25 MHz frequencies. The elements L3 and C9 are added to optimize impedances for the amplifier and resistor R9 is added to control the amount of attenuation of the 47.25 MHz sound carrier.

By adjusting the bandwidth of the SAW filter SAW1, the gain of the amplifier and the circuit elements associated with the 47.25 MHz trap, the resulting gain control signal applied to the tuner can not only be optimized to prevent overload of

a much greater variation of interfering signal levels, but also optimized for both digital and analog interfering signals.

Figure 4 shows a plot of output voltage vs. frequency for a signal applied to the SAW filter input at point A (in Figure 2) and an output voltage measured at point C. Two frequency responses are shown. Curve X is without the addition of the 47.25 MHz trap elements, namely C9, R9 and X1. Curve Y is taken with these elements added and shows the adjustment in frequency response made to optimize operation for analog interfering signals. The frequency response between 47.00 and 48.00 MHz is the adjacent channel bandwidth that is processed to effect the tuner gain control in the presence of the above adjacent channel interference.

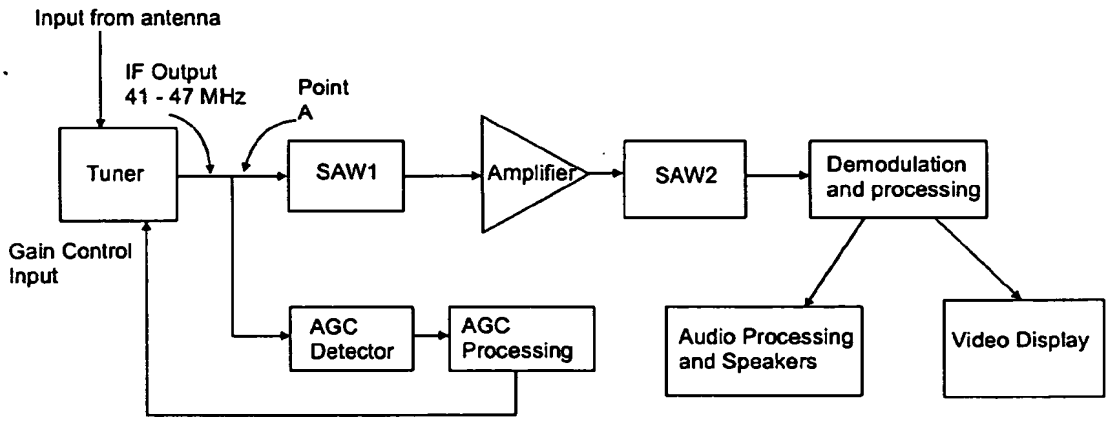

Figure 1

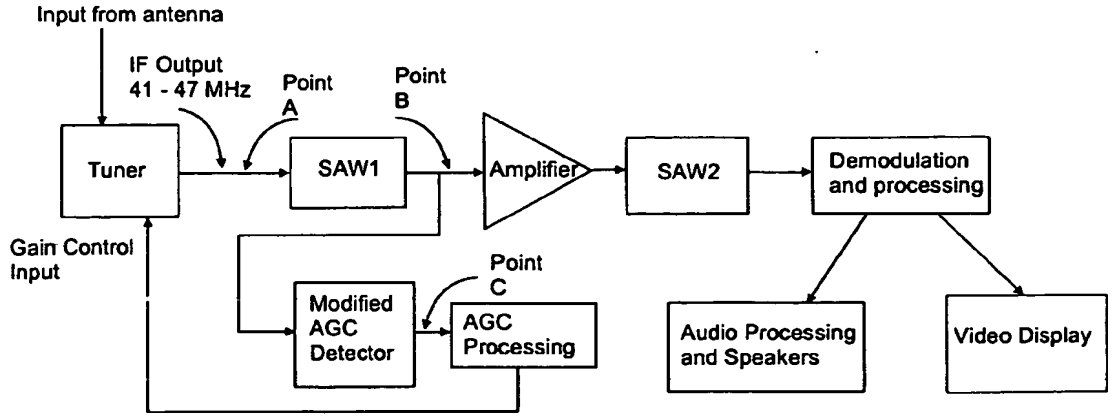

Figure 2

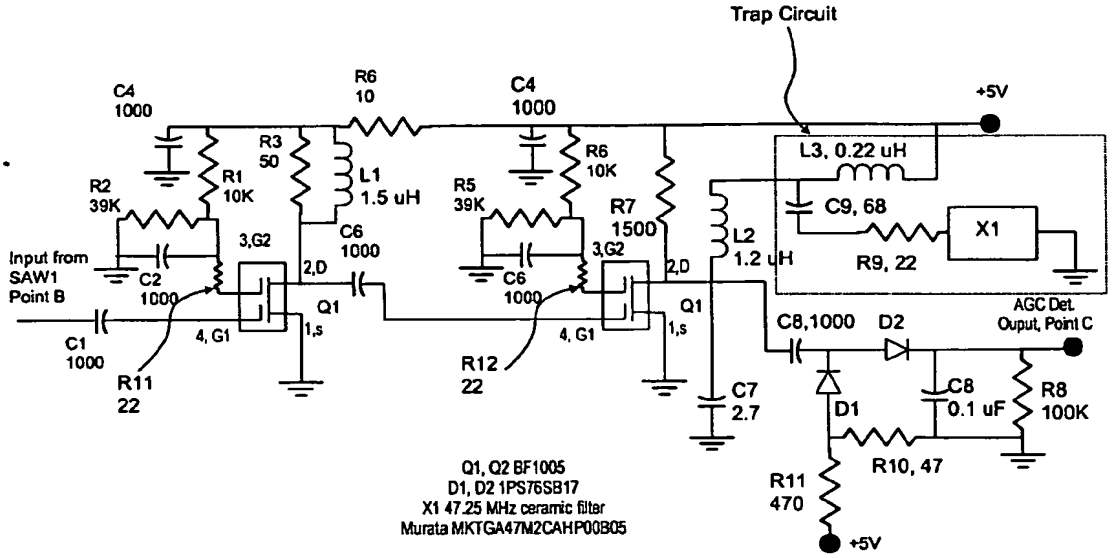

Figure 3

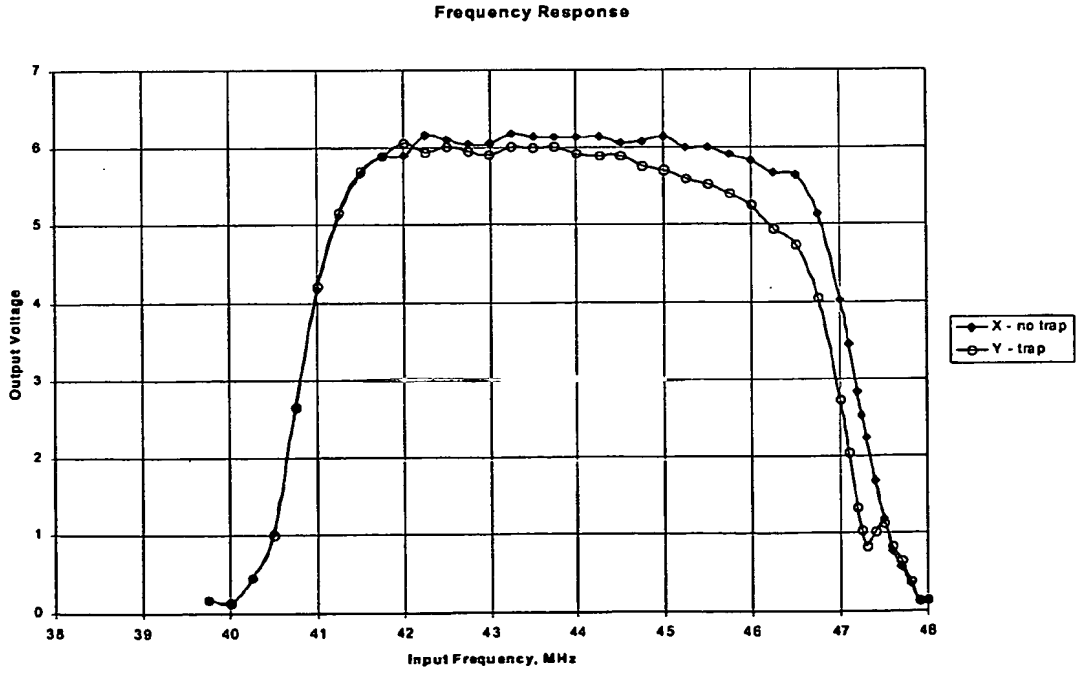

Figure 4

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US04/041855

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